E-PDISO16

Isolated Input and Relay Output Ethernet Interface Module

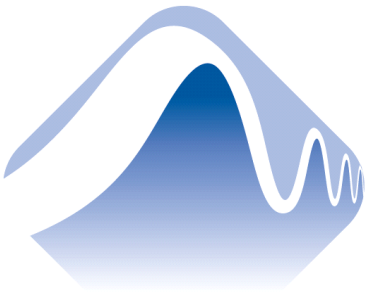
User's Guide

MEASUREMENT COMPUTING™

E-PDISO16

Isolated Input and Relay Output Ethernet Interface Module

User's Guide



MEASUREMENT COMPUTING™

Document Revision 4, June, 2006
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About this User's Guide

What you will learn from this user's guide

This user's guide explains how to install and configure the E-PDISO16 so that you get the most out of its isolated input and relay output features.

Conventions in this user's guide

For more information on …

Text presented in a box signifies additional information and helpful hints related to the subject matter you are reading.

Caution! Shaded caution statements present information to help you avoid injuring yourself and others, damaging your hardware, or losing your data.

<#:#> Angle brackets that enclose numbers separated by a colon signify a range of numbers, such as those assigned to registers, bit settings, etc.

bold text **Bold** text is used for the names of objects on the screen, such as buttons, text boxes, and check boxes. For example:
1. Insert the disk or CD and click the **OK** button.

italic text *Italic* text is used for the names of manuals and help topic titles, and to emphasize a word or phrase. For example:
The *Insta*Cal® installation procedure is explained in the *Quick Start Guide*.
Never touch the exposed pins or circuit connections on the board.

Where to find more information

The following electronic documents provide information relevant to the operation of the E-PDISO16.

- MCC's *Specifications: E-PDISO16* (the PDF version of the Electrical Specification Chapter in this guide) is available on our web site at www.mccdaq.com/pdfs/E-PDISO16.pdf.
- MCC's *Quick Start Guide* is available on our web site at www.mccdaq.com/PDFmanuals/DAQ-Software-Quick-Start.pdf.
- MCC's *Guide to Signal Connections* is available on our web site at www.mccdaq.com/signals/signals.pdf.
- MCC's *Universal Library User's Guide* is available on our web site at www.mccdaq.com/PDFmanuals/sm-ul-user-guide.pdf.
- MCC's *Universal Library Function Reference* is available on our web site at www.mccdaq.com/PDFmanuals/sm-ul-functions.pdf.
- MCC's *Universal Library for LabVIEW™ User's Guide* is available on our web site at www.mccdaq.com/PDFmanuals/SM-UL-LabVIEW.pdf.

E-PDISO16 User's Guide (this document) is also available on our web site at www.mccdaq.com/PDFmanuals/E-PDISO16.pdf.

Introducing the E-PDISO16

Overview: E-PDISO16 features

This user's guide contains all of the information you need to connect the E-PDISO16 to your network or computer and to the external devices you want to control. You can use the E-PDISO16 in your control applications to switch on and off a variety of devices, such as fans, blowers, pumps, etc.

The E-PDISO16 is a data acquisition Ethernet interface module supported under Microsoft® Windows® 2000 and Windows XP.

The E-PDISO16 provides 16 relay outputs and 16 isolated digital inputs. All I/O connections are made to three sets of screw terminals on the module.

The 16 individual, optically isolated (500 V) digital inputs can be driven by either AC (50 to 1000 Hz) or DC at levels up to 30 volts. Each input channel has a software-enabled low-pass AC filter with a time constant of 5 ms (200 Hz). The 16 inputs can be read back as a single byte.

The 16 outputs are single-pole double-throw (SPDT) dry contact, Form-C electromechanical relays. The screw terminals provide three connections to each relay – normally open (NO), normally closed (NC), and common (C). The relays are in a non-energized state (NC) upon power up.

The E-PDISO16 is powered by an external +9 V regulated power supply that is shipped with the module. A power output lets you power additional Measurement Computing products from one external power supply. Depending on your load requirement, daisy-chained modules may require a separate power supply.

On-board LEDs display the status of communication, external power, and the Ethernet connection. A fourth LED is used for testing purposes.

The E-PDISO16 is shipped in a rugged metal enclosure that you can mount on a DIN rail or on a bench.

Ethernet interface

The E-PDISO16 has one built-in 10/100 BASE-T auto-negotiation, high-speed communication port. With the Ethernet interface, you can remotely access and configure your E-PDISO16 from anywhere on the network. Only one computer can control the E-PDISO16 at one time. The networking protocol is TCP/IP. You can send your data over 100 meters at data speeds of up to 100 Mbps using only one Ethernet cable connected to your computer.

You configure the Ethernet connection settings with *Insta*Cal. MCC assigns a unique physical (MAC) address to each module you connect to your network. You can restore the factory-default Ethernet connection settings with an on-board RESET button.

Max number of TCP connections to the E-PDISO16

The maximum number of TCP connections that may concurrently be connected to the E-PDISO16 is three. The first user to establish a TCP connection can change the configurations and write to the outputs. The remaining two users may access the unit on a "read-only" basis. An attempt by a fourth user to gain a connection with the E-PDISO16 will not be acknowledged. Performance of these three concurrent connections will be subject to the limitations of the network topology and the network traffic that they are connected to.

Configuration information

For more information on *Insta*Cal and the Ethernet configuration settings for your E-PDISO16, refer to the "PDISO8 and PDISO16 Series" section of the "Digital Input/Output Boards" chapter in the *Universal Library User's Guide*. This document is available on our web site at www.mccdaq.com/PDFmanuals/sm-ul-user-guide.pdf.

Software features

For information on the features of *Insta*Cal and the other software included with your E-PDISO16, refer to the *Quick Start Guide* that shipped with your device. The *Quick Start Guide* is also available in PDF at www.mccdaq.com/PDFmanuals/DAQ-Software-Quick-Start.pdf.

Check http://www.mccdaq.com/download.htm for the latest software version or versions of the software supported under less commonly used operating systems.

E-PDISO16 block diagram

E-PDISO16 functions are illustrated in the block diagram shown here.

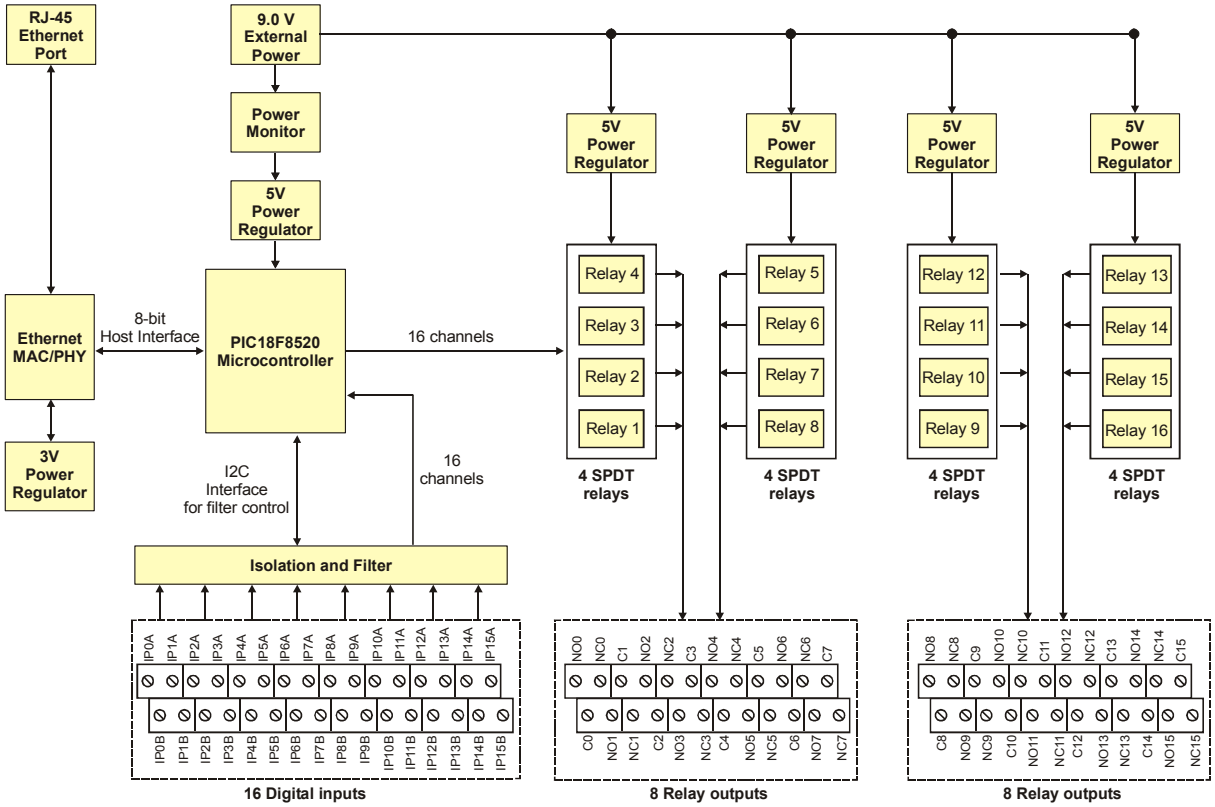

RJ-45 Ethernet Port
9.0 V External Power
Power Monitor
5V Power Regulator
Ethernet MAC/PHY
8-bit Host Interface
PIC18F8520 Microcontroller
16 channels
3V Power Regulator
I2C Interface for filter control
16 channels
Isolation and Filter
5V Power Regulator
5V Power Regulator
5V Power Regulator
5V Power Regulator
Relay 4
Relay 3
Relay 2
Relay 1
Relay 5
Relay 6
Relay 7
Relay 8
Relay 12
Relay 11
Relay 10
Relay 9
Relay 13
Relay 14
Relay 15
Relay 16
4 SPDT relays
4 SPDT relays
4 SPDT relays
4 SPDT relays
IP0A IP1A IP2A IP3A IP4A IP5A IP6A IP7A IP8A IP9A IP10A IP11A IP12A IP13A IP14A IP15A
IP0B IP1B IP2B IP3B IP4B IP5B IP6B IP7B IP8B IP9B IP10B IP11B IP12B IP13B IP14B IP15B
16 Digital inputs
NO0 NC0 C1 NO2 NC2 C3 NO4 NC4 C5 NO6 NC6 C7
C0 NO1 NC1 C2 NO3 NC3 C4 NO5 NC5 C6 NO7 NC7
8 Relay outputs
NO8 NC8 C9 NO10 NC10 C11 NO12 NC12 C13 NO14 NC14 C15
C8 NO9 NC9 C10 NO11 NC11 C12 NO13 NC13 C14 NO15 NC15
8 Relay outputs

Figure 1-1. E-PDISO16 functional block diagram

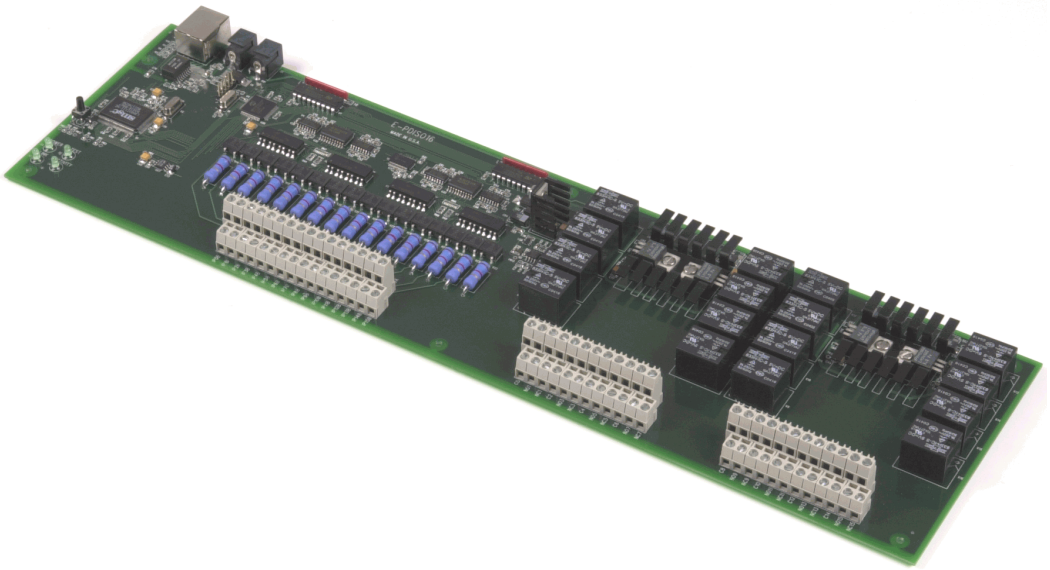
Installing the E-PDISO16

What comes with your E-PDISO16 shipment?

As you unpack your E-PDISO16, make sure that the following components are included.

Hardware

- E-PDISO16 (shown removed from case)



- External power supply and cord (CB-PWR-9V3A) – 9 volt, 3 amp DC power supply

Additional documentation

In addition to this hardware user's guide, you should also receive the *Quick Start Guide* (available in PDF at www.mccdaq.com/PDFmanuals/DAQ-Software-Quick-Start.pdf). This booklet supplies a brief description of the software you received with your E-PDISO16 and information regarding installation of that software. Please read this booklet completely before installing any software or hardware.

Unpacking the E-PDISO16

As with any electronic device, you should take care while handling to avoid damage from static electricity. Before removing the E-PDISO16 from its packaging, ground yourself using a wrist strap or by simply touching the computer chassis or other grounded object to eliminate any stored static charge.

If your E-PDISO16 arrives already damaged, notify Measurement Computing Corporation immediately by phone, fax, or email. For international customers, contact your local distributor where you purchased the E-PDISO16.

- Phone: 508-946-5100 and follow the instructions for reaching Tech Support.
- Fax: 508-946-9500 to the attention of Tech Support
- Email: techsupport@mccdaq.com

Installing the software

Refer to the *Quick Start Guide* for instructions on installing the software on the *Measurement Computing Data Acquisition Software CD*. This booklet is available in PDF at www.mccdaq.com/PDFmanuals/DAQ-Software-Quick-Start.pdf.

Connecting the external power supply

Power to the E-PDISO16 is provided with the +9 V, 3 A external power supply (CB-PWR-9V3A). It does not matter if you connect the external power cable before or after you connect the Ethernet cable. To connect the power supply to your E-PDISO16, do the following.

1. Connect the +9 V DC power supply cord to the connector labeled **POWER IN** on the E-PDISO16 enclosure (**IN** on the module). Refer to Figure 3-1 on page 3-1 for the location of this connector.
2. Plug the power cord into an electrical outlet.

The **POWER** LED illuminates when +9 V power is supplied to the E-PDISO16. If the voltage supply is less than +6.0 V or more than +12.5 V, the **POWER** LED does not light.

Do not connect external power to the POWER OUT connector

The power connector labeled **POWER OUT** on the enclosure (**OUT** on the module) is used to power an additional Measurement Computing product. If you connect the external power supply to the **POWER OUT** connector, the E-PDISO16 does not receive power, and the **POWER** LED does not illuminate.

Connecting the Ethernet cable

Your computer communicates with the E-PDISO16 remotely via the Ethernet cable. To connect the Ethernet cable to the E-PDISO16 and to the network, do the following:

1. Connect the Ethernet cable to the Ethernet communication port on the E-PDISO16.

   Use a standard Ethernet CAT-5 shielded or unshielded twisted pair Ethernet cable.

2. Plug the cable into your network's Ethernet connection.

   The **LINK** LED illuminates steady green to indicate that you have established an Ethernet connection between your E-PDISO16 and the network.

Connecting the E-PDISO16 to your computer's Ethernet port

If your computer is not connected to a network, or if you just want to connect the E-PDISO16 directly to your computer, use a standard cross-over cable for your Ethernet connection (such as a BELKIN A3X126-07-YLW-M CAT cross-over cable). Connect the cross-over cable between the unused Ethernet port on your computer and the Ethernet port on the E-PDISO16. Once connected, set up your TCP/IP address using *Insta*Cal.

If the **LINK** LED is not illuminated, you cannot communicate with the network (or with the computer if you are connected directly). Refer to Chapter 5 Ethernet Troubleshooting for possible solutions to connection problems.

Configuring the E-PDISO16

What you need to do to configure the Ethernet parameters of the E-PDISO16 will depend on whether or not you have a DHCP server enabled on the network you are connecting to. If you don't know if the network has a DHCP server, consult your network administrator.

If your network does not have a DHCP server

If your network does not have a DHCP server, it will be necessary to set up a subnet that is compatible with the default settings of the E-PDISO16. If you are not familiar with TCP/IP configuration, consult your network administrator. Once you have set up your network to be compatible with the default settings of the E-PDISO16, connect one E-PDISO16 to the network. The next step is to assign a unique IP address to this module. To do this, proceed to the Run *Insta*Cal section below. You'll need to assign a unique IP address to each E-PDISO16 you want to connect to your network.

If configuring a second device, you may need to delete the arp entry on your PC for the first device. The default IP address will be associated with the MAC address of the first device you configured. The second device will have the same default IP address, but a different MAC address. Because of this, the device at the default IP address may be reported as "unreachable". To resolve this conflict, refer to Chapter 5 Deleting an ARP table entry.

If your network does have a DHCP server

If your network has a DHCP server, the E-PDISO16 should be assigned an IP address shortly after being powered up and attached to the network. Proceed to the Run *Insta*Cal section below. *Insta*Cal will display the ethernet settings assigned to the E-PDISO16.

Run *Insta*Cal

After connecting the external power and the Ethernet cable to the E-PDISO16 module, run the *Insta*Cal software and add the module to *Insta*Cal's configuration file. Refer to the *Quick Start Guide* that shipped with the module for instructions.

After adding the E-PDISO16 to *Insta*Cal's configuration file, configure your Ethernet connection and AC filter settings with *Insta*Cal. If your network does not have a DHCP server, disable DHCP on the E-PDISO16.

Dynamic Host Configuration Protocol (DHCP)

Dynamic Host Configuration Protocol (DHCP) is a service that automatically assigns IP addresses to clients supporting the protocol. The default DHCP setting for the E-PDISO16 is *Enabled*.

A DHCP-based device does not have a permanently assigned IP address. When you power-up or reboot the computer, the DHCP client requests an IP address from the DHCP server. The DHCP server assigns and keeps track of all IP addresses for that sub-net.

When a DHCP device requests an IP address, the DHCP server assigns, or "leases", a unique IP address to the requesting device. The assigned IP address remains assigned to that device for a specified period, called the *lease duration*. At the end of the lease duration, the lease is either renewed or the IP address becomes available for assignment to another client.

If the DHCP client assigned to an IP address either reboots or powers down and up again, the client requests another IP address from the DHCP server, and the DHCP server assigns an IP address as before. There is no guarantee that the IP address is the same address previously assigned.

DHCP is a practical and efficient way of assigning and keeping track of IP addresses. If two clients are assigned the same IP address, a communication failure will result that affects both devices.

If DHCP is disabled

If DHCP is not enabled, enter a static IP address into your E-PDISO16. The default DHCP setting is *Enabled*. Unless you have a reason to disable DHCP (such as your network server is not DHCP-enabled), we recommend that you leave DHCP enabled.

If you are not familiar with networks and their configurations, consult your network administrator prior to installing the E-PDISO16. They can tell you if your network has a DHCP server, and if not, what static IP address to use.

Caution! Assigning an arbitrary IP address could result in duplicate IP addresses on the network. This condition can cause a communication failure that affects both devices.

Detecting a duplicate IP address

The E-PDISO16 can detect a duplicate IP address on the network. If the E-PDISO16 detects a duplicate IP address, its **TEST** LED will flash continuously.

The only way to return the module to a stable state is to press the factory default button. This will reset the module to the factory default configuration.

IP address

An Internet Protocol (IP) address is a unique 32-bit address that identifies a device on a TCP/IP network. An IP address can be set dynamically (by a DHCP-enabled server), or you can enter a "static" address. The address is typically represented in dotted decimal notation, which is defined as four groups of decimal numbers separated by periods. The numbers can be between 0 and 255, inclusive. The default IP address is *10.0.2.251*.

Subnet mask

A subnet mask is a code that helps a network device determine how a network's subnet is structured. The code is represented in dotted decimal notation. The default subnet mask is *255.255.255.252*.

Gateway

A gateway is the IP address of the device that bridges subnets within a network. The gateway address is typically represented in dotted decimal notation. The default gateway address is *10.0.2.1*.

Configuration information

For more information on the Ethernet configuration settings for your E-PDISO16, refer to the "PDISO8 and PDISO16 Series" section of the "Digital Input/Output Boards" chapter in the *Universal Library User's Guide*. This document is available on our web site at www.mccdaq.com/PDFmanuals/sm-ul-user-guide.pdf.

Functional Details

Internal components

The E-PDISO16 has the following external components, as shown in Figure 3-1.

- Ethernet port
- Two (2) external power connectors
- Four status LEDs (POWER, LINK, ACTIVITY, and TEST)
- Factory default button
- Screw terminal bank for 16 digital input connections (IP0A through IP15B)
- Screw terminal bank for eight relay output connections (NO0 through NC7)
- Screw terminal bank for eight relay output connections (NO8 through NC15)

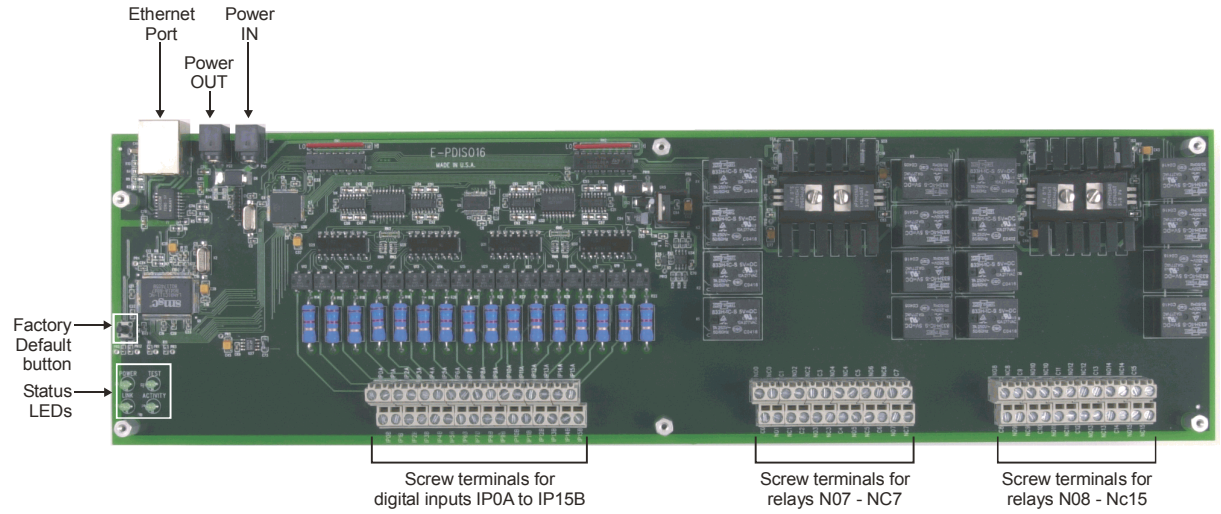

Ethernet Port
Power IN
Power OUT
Factory Default button
Status LEDs
Screw terminals for digital inputs IP0A to IP15B
Screw terminals for relays N07 - NC7
Screw terminals for relays N08 - Nc15

Figure 3-1. E-PDISO16 module components

Ethernet port

The E-PDISO16 has one 10/100 BASE-T, auto-negotiation, high-speed communication port. The port connector is an RJ-45, eight-position connector. The Ethernet port accepts CAT-5 shielded or unshielded twisted pair cable. The maximum communication distance without using a repeater is 100 meters. You can send your data 100 meters at data speeds of up to 100 Mbps using only one Ethernet cable connected to your computer.

External power connectors

The E-PDISO16 has two external power connectors labeled **Power IN** and **Power OUT**. Connect the **Power IN** connector to the supplied +9 V, external power supply (CB-PWR-9V3A). The **Power OUT** connector lets you power additional Measurement Computing products from a single external power supply.

The maximum output current is 3 A. When running at full load, that is, when all relays are *on* and the Ethernet is transferring data, the E-PDISO16 draws 1.7 A from the supply. Depending on your load requirements, additional products may require a separate power supply.

POWER LED

The **POWER** LED is steady green when external power is supplied. The E-PDISO16 has an on-board voltage supervisory circuit that monitors the 9 V external power supply. Table 3-1 explains the function of the **POWER** LED.

Table 3-1. POWER LED indicators

When the LED is…	It indicates…
Steady green	6.0 V to 12.5 V external power is supplied to the E-PDISO16.
Off	▪ Power is not supplied by the external supply (verify that the supply is connected to the power connector labeled **Power IN**.) ▪ A power fault has occurred. A power fault occurs when the input power falls outside of the specified voltage range of the external supply (6.0 V to 12.5 V).

LINK LED

The **LINK** LED is steady green when a connection is made between the E-PDISO16 and your network, or the E-PDISO16 and your computer if you are connected directly. Table 3-2 explains the function of the **LINK** LED.

Table 3-2. LINK LED indicators

When the LED is…	It indicates…
Steady green	A valid Ethernet connection is established between the E-PDISO16 and the network.
Off	Check the following: ▪ The Ethernet cable is not connected to the E-PDISO16 ▪ The Ethernet cable is not connected to the network ▪ The Ethernet cable is damaged ▪ External power is not supplied

ACTIVITY LED

The **ACTIVITY** LED blinks green when a data packet is sent or received over the Ethernet connection. Table 3-3 explains the function of the **ACTIVITY** LED.

Table 3-3. ACTIVITY LED indicators

When the LED is…	It indicates…
Blinking green	Data is being transmitted or received over the Ethernet connection.
Steady green	Your network traffic has reached its maximum limit, and no communication is possible. Check with your Network Administrator.
Off	The Ethernet is idle.

During normal operation, the **ACTIVITY** LED flashes periodically, depending on the traffic on your network.

If the **ACTIVITY** LED is solid green, then your network's traffic has reached its limit and no communication is possible. Check with your network administrator.

TEST LED

The **TEST** LED blinks green when commanded to by software, and when you are performing *Insta*Cal testing procedures on the E-PDISO16.

The **TEST** LED flashes continuously when a duplicate IP address is detected on the network by the E-PDISO16. Press the factory default button to reset the module to the factory default configuration.

Factory default button

The factory default button resets the Ethernet parameters, filter, and relay conditions on the E-PDISO16 to the factory default settings. Press and hold this button for three seconds to reset the E-PDISO16 to the factory default configuration.

Screw terminal wiring

The E-PDISO16 has three rows of screw terminals for digital input and relay output connections. Use 14 AWG to 20 AWG wire for your signal connections.

Caution! **Keep the length of stripped wire at a minimum to avoid a short to the enclosure.** When connecting your field wiring to the screw terminals, use the strip gage on the terminal strip, or strip to 5.5 - 7.0 mm (0.215" to 0.275") long.

Each screw terminal is identified with a label on the module and on the underside of the enclosure lid. Refer to Table 3-4 for the signal name associated with each module label.

Table 3-4. Module labels and associated signal names

Pin	Signal Name	Pin	Signal Name
IP0A	Input 0 terminal A	IP8A	Input 8 terminal A
IP0B	Input 0 terminal B	IP8B	Input 8 terminal B
IP1A	Input 1 terminal A	IP9A	Input 9 terminal A
IP1B	Input 1 terminal B	IP9B	Input 9 terminal B
IP2A	Input 2 terminal A	IP10A	Input 10 terminal A
IP2B	Input 2 terminal B	IP10B	Input10 terminal B
IP3A	Input 3 terminal A	IP11A	Input 11 terminal A
IP3B	Input 3 terminal B	IP11B	Input 11 terminal B
IP4A	Input 4 terminal A	IP12A	Input 12 terminal A
IP4B	Input 4 terminal B	IP12B	Input 12 terminal B
IP5A	Input 5 terminal A	IP13A	Input 13 terminal A
IP5B	Input 5 terminal B	IP13B	Input 13 terminal B
IP6A	Input 6 terminal A	IP14A	Input 14 terminal A
IP6B	Input 6 terminal B	IP14B	Input 14 terminal B
IP7A	Input 7 terminal A	IP15A	Input 15 terminal A
IP7B	Input 7 terminal B	IP15B	Input 15 terminal B
NO0	Relay 0 Normally Open contact	NO8	Relay 8 Normally Open contact
C0	Relay 0 Common contact	C8	Relay 8 Common contact
NC0	Relay 0 Normally Closed contact	NC8	Relay 8 Normally Closed contact
NO1	Relay 1 Normally Open contact	NO9	Relay 9 Normally Open contact
C1	Relay 1 Common contact	C9	Relay 9 Common contact
NC1	Relay 1 Normally Closed contact	NC9	Relay 9 Normally Closed contact
NO2	Relay 2 Normally Open contact	NO10	Relay 10 Normally Open contact
C2	Relay 2 Common contact	C10	Relay 10 Common contact
NC2	Relay 2 Normally Closed contact	NC10	Relay 10 Normally Closed contact
NO3	Relay 3 Normally Open contact	NO11	Relay 11 Normally Open contact
C3	Relay 3 Common contact	C11	Relay 11 Common contact
NC3	Relay 3 Normally Closed contact	NC11	Relay 11 Normally Closed contact
NO4	Relay 4 Normally Open contact	NO12	Relay 12 Normally Open contact
C4	Relay 4 Common contact	C12	Relay 12 Common contact
NC4	Relay 4 Normally Closed contact	NC12	Relay 12 Normally Closed contact
NO5	Relay 5 Normally Open contact	NO13	Relay 13 Normally Open contact
C5	Relay 5 Common contact	C13	Relay 13 Common contact
NC5	Relay 5 Normally Closed contact	NC13	Relay 13 Normally Closed contact
NO6	Relay 6 Normally Open contact	NO14	Relay 14 Normally Open contact
C6	Relay 6 Common contact	C14	Relay 14 Common contact
NC6	Relay 6 Normally Closed contact	NC14	Relay 14 Normally Closed contact
NO7	Relay 7 Normally Open contact	NO15	Relay 15 Normally Open contact
C7	Relay 7 Common contact	C15	Relay 15 Common contact
NC7	Relay 7 Normally Closed contact	NC15	Relay 15 Normally Closed contact

Relay output terminals (NO0 to NC15)

The E-PDISO16 provides 16 Form C electromechanical relay outputs. The Form C relay has a common (C), normally open (NO) and normally closed (NC) contact.

The screw terminals labeled **NO0** to **NC7** connect to the NO, C, and NC contacts for relays 0 through 7. The screw terminals labeled **NO8** to **NC15** connect to the NO, C, and NC contacts for relays 8 through 15.

Form C relay output

A schematic for Form C relay contacts is shown in Figure 3-2.

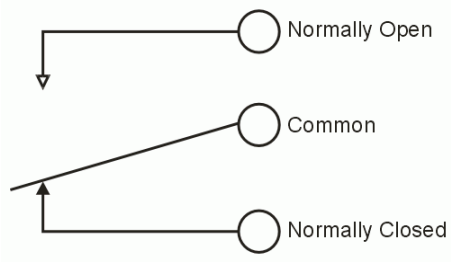


Figure 3-2. Form C relay contacts

Two 4.7 k pull-down resistor networks on the E-PDISO16 control the power-up state of each relay bank. At power-up, the relays are put into a non-energized state (NC in contact to Common).

Relay contact protection circuit for inductive loads

If you are using the relays to control inductive loads, place a diode across the load terminals to suppress the kickback voltage. If the diode is not present, the kickback voltage could cause the on-board processor to enter an unstable state. To return the processor to a stable state, unplug the power cable from the E-PDISO16 and then reconnect.

A contact protection circuit is shown in Figure 3-3. For AC loads, install a metal oxide varistor (MOV).

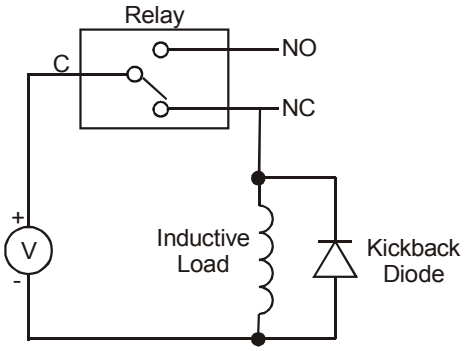


Figure 3-3. Relay contact protection circuit

Digital input terminals (IP0A to IP15B)

The E-PDISO16 has 16 isolated digital inputs. Connect up to 16 isolated differential digital input signals using the following screw terminal pairs:

▪ IP0A and IP0B	▪ IP8A and IP8B
▪ IP1A and IP1B	▪ IP9A and IP9B
▪ IP2A and IP2B	▪ IP10A and IP10B
▪ IP3A and IP3B	▪ IP11A and IP11B
▪ IP4A and IP4B	▪ IP12A and IP12B
▪ IP5A and IP5B	▪ IP13A and IP13B
▪ IP6A and IP6B	▪ IP14A and IP14B
▪ IP7A and IP7B	▪ IP15A and IP15B

A schematic of a single channel is shown in Figure 3-4. The signals are routed through a bridge rectifier so that the inputs are not polarity-sensitive. It can be driven by either AC (50 - 1000 Hz) or DC voltage up to ±30 VDC.

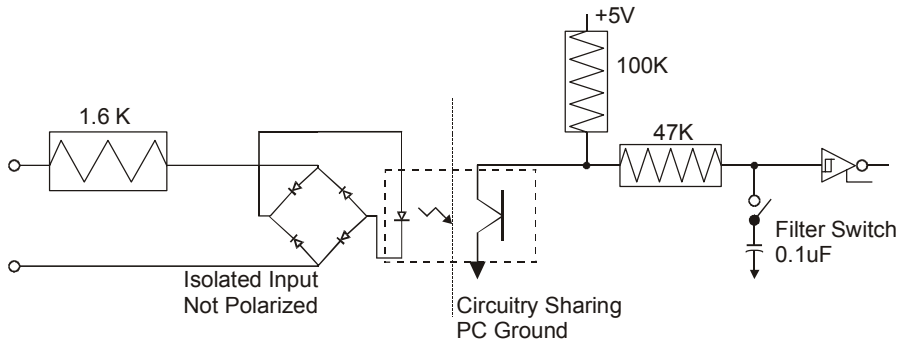


Figure 3-4. Single-channel configuration

The 16 optically-isolated (500 V) inputs can be read back as a single byte. Each input has a software-controlled filter with a time constant of 5 ms (200 Hz). The filter is required for AC inputs, and recommended for almost all DC inputs. Unless you have a good reason to turn off a filter, we recommend that you enable it.

Extending the input range

To extend the input range beyond the 5 to 30 V specified, add an external resistor. Figure 3-5 shows the external resistor (R_{ext}) and the equations used to calculate resistor values for a given V_{in}. The equation $\mathbf{R_{ext} = 100 * (V_{in} - 30)}$ calculates the resistor value for a given V_{in}.

Make sure the external resistor is capable of handling the power generated by the input. Calculate the power requirement in watts (P_w) using the equation $\mathbf{P_w = R_{ext}/10000}$.

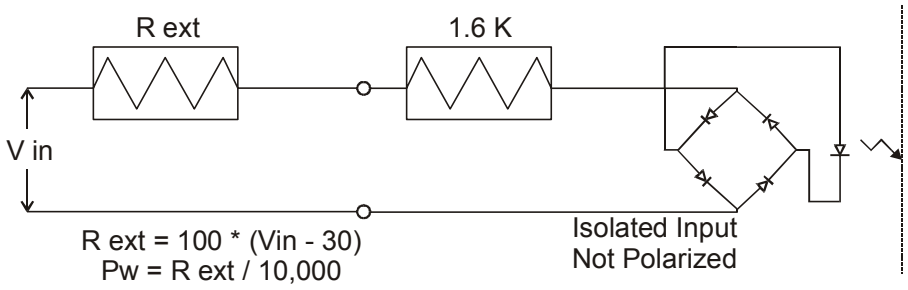


Figure 3-5. External resistor added to extend input range

Digital I/O Techniques

For more information about digital I/O techniques, refer to the *Guide to Signal Connections*. This document is available on our web site at www.mccdaq.com/signals/.

Power limitations using multiple E-PDISO16 modules

The maximum output current of the supplied CB-PWR-9V3A power supply is 3 A. When running at full load (all relays on and the Ethernet is active), the E-PDISO16 draws 1.7 A from the supply. If you daisy chain additional Measurement Computing products to the E-PDISO16, make sure you provide adequate power to each module that you connect.

A drop in voltage occurs with each module connected in a daisy chain system. The voltage drop between the external power supply and the daisy chain output is 0.5 V max. Factor in this voltage drop when you configure a daisy chain system to ensure that at least 6.0 VDC is provided to the last module in the chain.

Ethernet Troubleshooting

There are typically only two reasons when you cannot attach and communicate with your E-PDISO16. These are:

- The E-PDISO16 is configured incorrectly, or is operating incorrectly.
- Your network is configured incorrectly. Though the E-PDISO16 is functioning normally, you are unable to communicate with it.

Though a detailed treatment of debugging your network is beyond the scope of this manual, there are a few things you can try to determine if the problem you are experiencing is a problem with the board or with your network configuration. If you are unable to communicate with the E-PDISO16, perform this troubleshooting procedure to try and identify the problem:

1. Check to see if the **POWER** LED on the E-PDISO16 is on (steady green). The POWER LED indicates that external power is supplied to the E-PDISO16.
   - If the POWER LED is off, check the power cable and the socket that the cable is plugged into.
   - If the cable is good, plugged in, and the power to the socket is on, then the E-PDISO16 is not powering up correctly. Contact MCC technical support. Refer to Getting help on page 4-3 for contact information.
2. Check to see if the **LINK** LED is on (steady green). The LINK LED indicates a valid Ethernet connection between the E-PDISO16 and the server/hub/switch it is connected to. If the LINK LED is off, check the following:
   - Check the Ethernet cable — verify that the Ethernet cable is the correct type, is not damaged, and that it is connected correctly between the E-PDISO16 and a known functional server/hub/switch (or connected to your computer if you are connected directly).
   - If the Ethernet cable is plugged into a wall socket, check with your Network Administrator that the wall socket is active and that it is connected to an active server/hub/switch.

     If you are properly connected to an active server/hub/switch and the LINK LED is still off, there is a problem with the E-PDISO16. Contact MCC technical support. Refer to Getting help on page 4-3 for contact information.
3. If your E-PDISO16 is connected to a network, check to see if the **ACTIVITY** LED is flashing green. The ACTIVITY LED is an indication of transmitted and received data to and from the network. If the LED is solid green or not flashing at all, check the following:
   - If the ACTIVITY LED is solid green, your network's traffic is at its maximum limit and no communication is possible. Check with your network administrator.
   - If the ACTIVITY LED is not flashing at all, there are two possibilities:

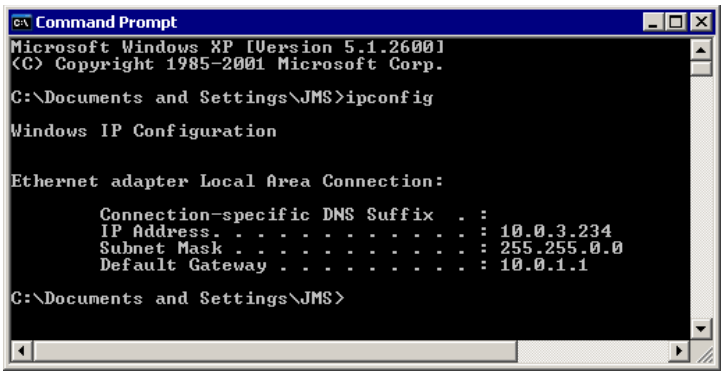
     Even though the E-PDISO16 is connected to a good server/hub/switch, it is not connected to your network. An average network has at least some traffic that causes the **ACTIVITY** LED to blink. Check with your network administrator.

     If the network administrator verifies the network connection, the E-PDISO16 is not receiving. Contact MCC technical support. Refer to Getting help on page 4-3 for contact information.

4. If your E-PDISO16 is connected directly to a computer via a cross-over cable or a single hub/switch, check to see if the **ACTIVITY** LED flashes when you try to communicate with the module. The ACTIVITY LED flashes if there is any traffic coming from the computer. If it is not flashing at all, there are two possibilities:

   - There is an issue with the TCP/IP settings that is keeping your computer from transmitting. Verify that your TCP/IP settings are correct, and that you are using a valid IP address for both your computer and E-PDISO16. A simple way to do this is to open a DOS Command Prompt window from your computer. Run the DOS prompt from Start►Programs►Accessories►Command Prompt. When the DOS window opens, type in "*IPCONFIG*" and press the **Return** key.

     Your computer should return a message similar to the message shown here.


Command Prompt
Microsoft Windows XP [Version 5.1.2600]
(C) Copyright 1985-2001 Microsoft Corp.
C:\Documents and Settings\JMS>ipconfig
Windows IP Configuration
Ethernet adapter Local Area Connection:
Connection-specific DNS Suffix . :
IP Address. . . . . : 10.0.3.234
Subnet Mask . . . . . : 255.255.0.0
Default Gateway . . . . . : 10.0.1.1
C:\Documents and Settings\JMS>

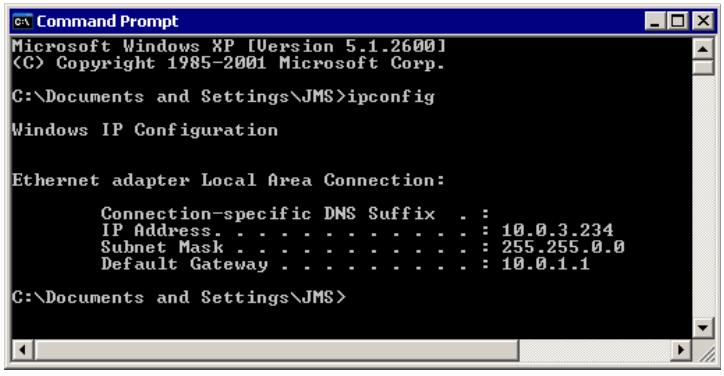
     If the IP Address or Subnet Mask information are all 0's, or if the first three numbers in either the IP address or IP Mask do not match the settings set in the E-PDISO16, then the computer will not be able to communicate with the E-PDISO16. If you are unfamiliar with how to set these parameters on your computer, check with your network administrator.

   - The E-PDISO16 is not receiving. Contact MCC technical support. Refer to Getting help on page 4-3 for contact information.

5. If the **ACTIVITY** LED is flashing, do the following:

   - Verify that your TCP/IP settings are correct, and that you are using a valid IP address for both your computer and E-PDISO16. A simple way to do this is to open a DOS Command Prompt window from your computer. Run the DOS prompt from Start►Programs►Accessories►Command Prompt. When the DOS window opens, type in "*IPCONFIG*" and press the **Return** key.

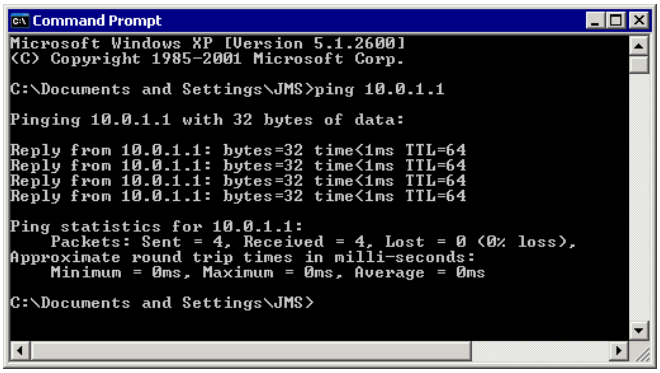
     Your computer should return a message similar to the message shown here.


Command Prompt
Microsoft Windows XP [Version 5.1.2600]
(C) Copyright 1985-2001 Microsoft Corp.
C:\Documents and Settings\JMS>ipconfig
Windows IP Configuration
Ethernet adapter Local Area Connection:
Connection-specific DNS Suffix . :
IP Address. . . . . : 10.0.3.234
Subnet Mask . . . . . : 255.255.0.0
Default Gateway . . . . . : 10.0.1.1
C:\Documents and Settings\JMS>

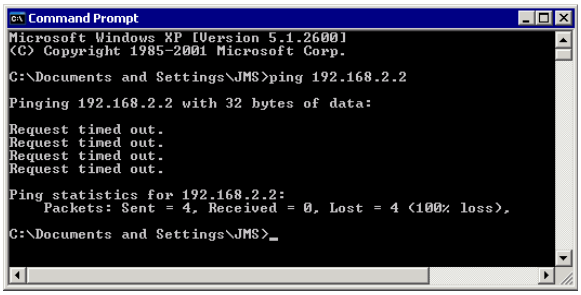
   - If the IP Address, Subnet Mask or Default Gateway information are all 0's, or that they do not match the settings for your network, then the computer will not be able to communicate with the E-PDISO16. If you are unfamiliar with how to set these parameters on your computer or do not know if they are correct for your network, check with your network administrator.

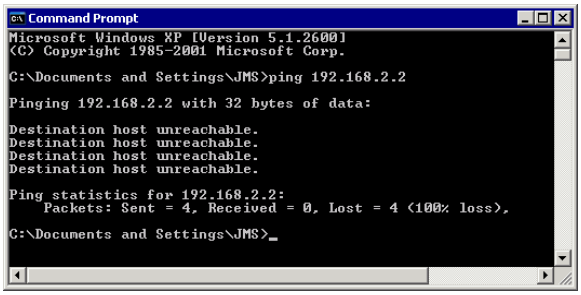
- Try to PING (Packet InterNet Groper) the Default Gateway with the IP Address listed. To use the PING command, type in "*PING* <Default Gateway's *IP Address listed in IPCONFIG*>" and press the **Return** key.

  A successful attempt to communicate with the Default Gateway returns this message.


Command Prompt
Microsoft Windows XP [Version 5.1.2600]
(C) Copyright 1985-2001 Microsoft Corp.
C:\Documents and Settings\JMS>ping 10.0.1.1
Pinging 10.0.1.1 with 32 bytes of data:
Reply from 10.0.1.1: bytes=32 time<1ms TTL=64
Reply from 10.0.1.1: bytes=32 time<1ms TTL=64
Reply from 10.0.1.1: bytes=32 time<1ms TTL=64
Reply from 10.0.1.1: bytes=32 time<1ms TTL=64
Ping statistics for 10.0.1.1:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum = 0ms, Average = 0ms
C:\Documents and Settings\JMS>

  If you receive either a "Request timed out" error or a "Destination host unreachable" error (shown below), then there is a problem with your computer connecting to your network. Check with your network administrator.


Command Prompt
Microsoft Windows XP [Version 5.1.2600]
(C) Copyright 1985-2001 Microsoft Corp.
C:\Documents and Settings\JMS>ping 192.168.2.2
Pinging 192.168.2.2 with 32 bytes of data:
Request timed out.
Request timed out.
Request timed out.
Request timed out.
Ping statistics for 192.168.2.2:
Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
C:\Documents and Settings\JMS>


Command Prompt
Microsoft Windows XP [Version 5.1.2600]
(C) Copyright 1985-2001 Microsoft Corp.
C:\Documents and Settings\JMS>ping 192.168.2.2
Pinging 192.168.2.2 with 32 bytes of data:
Destination host unreachable.
Destination host unreachable.
Destination host unreachable.
Destination host unreachable.
Ping statistics for 192.168.2.2:
Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
C:\Documents and Settings\JMS>

- If you know the IP address of the E-PDISO16, try to PING the unit. Use the same procedure listed previously, type in "*PING* <E-PDISO16's IP Address>" and press the **Return** key. If you get an error, then there are two possibilities:

  There is an issue with the settings on the E-PDISO16. Press the **RESET** button on the E-PDISO16 to reset the IP configuration settings to factory default. If you are using DHCP, the module will acquire an IP address. If you are not using DHCP, enter a valid IP address and re-establish communication.

  If the **RESET** button does not work, the microcontroller on the E-PDISO16 is not working. This is an E-PDISO16 problem. Contact MCC technical support. Refer to Getting help on page 4-3 for contact information.

Deleting an ARP table entry

To clear previous entries of the default IP address from the ARP table, do the following:

1. Open a Command Prompt (DOS) window.
2. Type "arp –a" at the prompt.
3. You should see an entry that includes the default IP address of the E-PDISO16 (10.0.2.251). This is the entry you need to remove.
4. To remove the default IP entry, type "arp –d 10.0.2.251" and press enter.
5. You should now be able to communicate with a new device at the default IP settings.

Getting help

If you are unable to communicate with the E-PDISO16, first contact your network administrator to verify that you are using the correct TCP/IP network settings, and that your network configuration is working.

If your network administrator has verified your network configuration and settings, and you still cannot communicate with the E-PDISO16, the problem may be with the E-PDISO16. For E-PDISO16-related issues, contact Measurement Computing Corporation technical support by phone, fax, or email. For international customers, contact your local distributor where you purchased the E-PDISO16.

- Phone: 508-946-5100 and follow the instructions for reaching Tech Support.
- Fax: 508-946-9500 to the attention of Tech Support
- Email: techsupport@mccdaq.com

Specifications

Typical for 25 °C unless otherwise specified.
Specifications in *italic text* are guaranteed by design.

Output relay specifications

Table 1. Output relay specifications

Number	16
Contact configuration	16 Form C (SPDT) NO, NC and Common available at connector
Contact rating	*6 amperes (A) @ 240 volts AC (VAC) or 28 volts DC (VDC) resistive*
Contact resistance	100 milliohms (mΩ) max.
Operate time	*10 milliseconds (ms) max.*
Release time	*5 ms max.*
Vibration	*10 to 55 hertz (Hz) (Dual amplitude 1.5 millimeters (mm))*
Shock	*10 G (11 ms)*
Dielectric isolation	*500 V (1 minute)*
Life expectancy	*10 million mechanical operations, min.*
Power on state	Not energized. NC in contact to Common.
State after RESET button activated	Not energized. NC in contact to Common.

Isolated inputs

Table 2. Isolated inputs specifications

Number	16		
Isolation	*500 volts (V)*		
Resistance	1.6 K ohms (Ω) min.		
Voltage range	DC	Input high:	+5.0 VDC min. or –5.0 VDC min.
		Input low:	+1.5 VDC max. or –1.5 VDC max.
		Input range:	± 30 VDC max.
	AC (with filter)	Input high:	4.0 V_{rms} min. (50-1000 Hz)
		Input low:	1.5 V_{rms} max. (50-1000 Hz)
Response	Without filter	20 µs	
	With filter	5 ms	
Filters	Time constant	5 ms (200 Hz)	
	Filter control	Software programmable at each input	
	Power-up	Filter setting is stored on-board and will remain at the last stored configuration	
	After RESET button activated	Filters off	

Power consumption

Table 3. Power consumption specifications

External power input		6.0 VDC to 12.5 VDC (9 VDC power supply provided)
External power supply (included)	MCC p/n CB-PWR-9V3A	9 V ±10% @ 3 A
Operating current	All relays off, Ethernet idle	250 mA typical, 320 mA max.
	All relays on, Ethernet idle	1.3 A typical, 1.6 A max.
	All relays on, Ethernet active	1.45 A typical, 1.7 A max.

Note 1: The E-PDISO16 monitors the external power supply with a voltage supervisory circuit. If this power supply exceeds the supervisor limits, the POWER LED will turn off, indicating a power fault condition.

External power output

Table 4. External power output specifications

Parameter	Conditions	Specification
External power output - current range	See Note 2	4.0 A max.
External power output - voltage range	The input voltage minus the output voltage at the daisy chain output.	0.5 V max.
Compatible cable(s) for daisy chain	C-MAPWR-x	x = 2, 3, or 6 feet

Note 2: The daisy chain power output option allows multiple Measurement Computing boards to be powered from a single external power source in a daisy chain fashion. The voltage drop between the module's power supply and the daisy chain output is 0.5 V max. Users must plan for this drop to ensure the last module in the chain will receive at least 6.0 V.

Ethernet compliance

Table 5. Ethernet compliance specifications

Device type	*IEEE 802.3 Ethernet 10/100Base-T*
Device compatibility	*IEEE 802.3-2003 10/100 Media Access Control*

Ethernet connection

Table 6. Ethernet connection specifications

Ethernet type	*10Base-T, 100Base-T*
Connector	*RJ-45, 8 position*
Cable	*CAT-5 shielded, unshielded twisted pair*
Length	*100 meters max.*
Max connections	3 (one control port and two monitoring ports)
MAC address	00:12:71:XX:XX:XX

EEProm memory

Table 7. EEProm memory specifications

EEProm memory	*1024 bytes residing in the processor*
Reserved space	*128 bytes, Address 0x00 to 0x7F*
User space	*896 bytes, Address 0x80 to 0x3FF*

Ethernet and input filter "Factory Default" settings

Table 8. Factory default specifications

Default IP address	10.0.2.251
Default IP mask	255.255.255.252
Default Gateway	10.0.2.1
Default DHCP setting	Enabled
Default Filter setting	All Filters Off

LED displays and the "Factory Default" button

Table 9. LED and button configurations

POWER LED	$6.0\ V < V_{ext} < 12.5\ V$ On $V_{ext} < 6.0\ V, V_{ext} > 12.5\ V$ Off (power fault)
TEST LED	Blinks when commanded to by software.
LINK LED	On when there is a valid Ethernet connection.
ACTIVITY	Blinks when an Ethernet packet is sent or received.
Factory default button	Returns the device to its factory default condition including resetting all Ethernet, filter and relay conditions.

Mechanical

Table 10. Mechanical specifications

Card dimensions	17.0" (L) x 4.8" (W) x 0.8" (H)
	431.8 mm (L) x 121 mm (W) x 20.3 mm (H)
Case dimensions	17.2" (L) x 5.2” (H) x 1.6” (H)
	436.9 mm (L) x 132.1 mm (W) x 40.6 mm (H)

Environmental

Table 11. Environmental specifications

Operating temperature range	0 to 70 °C
Storage temperature range	-40 to 100 °C
Humidity	0 to 95% non-condensing

Main connector

Table 12. Main connector specifications

Connector type	Screw terminal
Wire gauge range	14-30 AWG

Screw terminal pin out

Table 13. Screw terminal pin out specifications

Pin	Signal Name	Pin	Signal Name
IP0A	Input 0 terminal A	IP8A	Input 8 terminal A
IP0B	Input 0 terminal B	IP8B	Input 8 terminal B
IP1A	Input 1 terminal A	IP9A	Input 9 terminal A
IP1B	Input 1 terminal B	IP9B	Input 9 terminal B
IP2A	Input 2 terminal A	IP10A	Input 10 terminal A
IP2B	Input 2 terminal B	IP10B	Input10 terminal B
IP3A	Input 3 terminal A	IP11A	Input 11 terminal A
IP3B	Input 3 terminal B	IP11B	Input 11 terminal B
IP4A	Input 4 terminal A	IP12A	Input 12 terminal A
IP4B	Input 4 terminal B	IP12B	Input 12 terminal B
IP5A	Input 5 terminal A	IP13A	Input 13 terminal A
IP5B	Input 5 terminal B	IP13B	Input 13 terminal B
IP6A	Input 6 terminal A	IP14A	Input 14 terminal A
IP6B	Input 6 terminal B	IP14B	Input 14 terminal B
IP7A	Input 7 terminal A	IP15A	Input 15 terminal A
IP7B	Input 7 terminal B	IP15B	Input 15 terminal B
NO0	Relay 0 Normally Open contact	NO8	Relay 8 Normally Open contact
C0	Relay 0 Common contact	C8	Relay 8 Common contact
NC0	Relay 0 Normally Closed contact	NC8	Relay 8 Normally Closed contact
NO1	Relay 1 Normally Open contact	NO9	Relay 9 Normally Open contact
C1	Relay 1 Common contact	C9	Relay 9 Common contact
NC1	Relay 1 Normally Closed contact	NC9	Relay 9 Normally Closed contact
NO2	Relay 2 Normally Open contact	NO10	Relay 10 Normally Open contact
C2	Relay 2 Common contact	C10	Relay 10 Common contact
NC2	Relay 2 Normally Closed contact	NC10	Relay 10 Normally Closed contact
NO3	Relay 3 Normally Open contact	NO11	Relay 11 Normally Open contact
C3	Relay 3 Common contact	C11	Relay 11 Common contact
NC3	Relay 3 Normally Closed contact	NC11	Relay 11 Normally Closed contact
NO4	Relay 4 Normally Open contact	NO12	Relay 12 Normally Open contact
C4	Relay 4 Common contact	C12	Relay 12 Common contact
NC4	Relay 4 Normally Closed contact	NC12	Relay 12 Normally Closed contact
NO5	Relay 5 Normally Open contact	NO13	Relay 13 Normally Open contact
C5	Relay 5 Common contact	C13	Relay 13 Common contact
NC5	Relay 5 Normally Closed contact	NC13	Relay 13 Normally Closed contact
NO6	Relay 6 Normally Open contact	NO14	Relay 14 Normally Open contact
C6	Relay 6 Common contact	C14	Relay 14 Common contact
NC6	Relay 6 Normally Closed contact	NC14	Relay 14 Normally Closed contact
NO7	Relay 7 Normally Open contact	NO15	Relay 15 Normally Open contact
C7	Relay 7 Common contact	C15	Relay 15 Common contact
NC7	Relay 7 Normally Closed contact	NC15	Relay 15 Normally Closed contact

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